

REMARKS/ARGUMENTS

I. Introduction

Claims 21–52 are pending in the above application.

Claims 21–52 stand rejected under 35 U.S.C. §103(a).

II. Amendments

The applicant has amended claims 21, 24–27, 29, 34, 36, 38, 45 and 51–52, and canceled claims 22–23 and 49–50 without prejudice or disclaimer.

Applicant has amended independent claims 21, 38, and 45 to more particularly characterize applicants' invention as an apparatus and method of remote measurement using tunable diode lasers of selected trace constituents in exhaust gases. Applicant has made a minor voluntary amendment to the dependent claims 24–27, 29, 34, 36, and 51–52 to account for the amendments to claims 21, 38, and 45.

III. Rejection Under 35 U.S.C. §103(a)

Claims 21–52 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Partridge et al. (USPN 5,339,155) in view of Whittaker et al. (USPN 5,267,019) and Boide et al. (USPN 4,820,045).

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so, found in either the references themselves

or in the knowledge generally available to one of ordinary skill in the art. *In re Fine*, 837 F. 2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F. 2d 347, 21 USPQ 2d 1941 (Fed. Cir. 1992). See also MPEP 2143.01. It should be recognized that the fact that the prior art could be modified so as to result in the combination defined by the claims at bar would not have made the modification obvious unless the prior art suggests the desirability of the modification. *In re Deminski*, 796 F. 2d 436, 230 USPQ 313 (Fed. Cir. 1986). Recognizing, after the fact, that such a modification would provide an improvement or advantage, without suggestion thereof by the prior art, rather than dictating a conclusion of obviousness, is an indication of improper application of hindsight considerations. Simplicity and hindsight are not proper criteria for resolving obviousness. *In re Warner*, 379 F. 2d 1011, 154 USPQ 173 (CCPA 1967).

The Examiner has stated that Partridge et al. discloses an apparatus and method for measuring a gas, and that in the system of Partridge et al., the wavelength of a beam of light is scanned across the absorption line of the gas of interest. The Examiner relies on Whittaker et al., for showing that it is known that such wavelength scanning for such measurements can be obtained by modulating the wavelength of a tunable laser. The Examiner relies on Boide et al., to show that it is known to use optical fibers to carry light to and from measuring stations and that a single light source and detector can be used to monitor multiple test areas by multiplexing the light.

Applicant notes that Partridge et al. employs a broadband light source that uses an interference filter to modulate the wavelength of the radiation beam to obtain a specific wavelength band. The interference filter may be rotated to alter the transmitted wavelength to scan across an absorption band. This is a very inefficient approach in comparison to a tunable diode laser because it only transmits a small fraction of the radiation through the filter (see col. 4, lines 53–55).

Whittaker et al., shows a laboratory based instrument set-up where the modulated laser beam is directed *immediately* through a low-pressure cell onto a detector. The purpose of Whittaker et al., is to demonstrate that the particular triangular modulation applied to the laser reduces etalons.

Neither Partridge et al. nor Whittaker et al. teach or suggest either singly or combined, the claimed apparatus and method inasmuch as neither Partridge et al.

nor Whittaker et al., teach an apparatus (and corresponding method) for monitoring selected trace constituents in exhaust gases, the apparatus comprising a diode laser tuneable over a range of frequencies for generating a laser beam, the diode laser located remotely from the exhaust gases, transmission means, remote from the diode laser and connected to the laser by optical fiber connection means, the transmission means to transmit the laser beam through the exhaust gas, detection means for detecting the laser beam after transmission through the exhaust gas, control means to control the frequency of the laser to scan repeatedly and rapidly across an absorption range encompassing an absorption line of a selected trace constituent of interest, the control means having a two-tone generator to generate a frequency signal and to output said signal as a two-tone frequency modulated signal and as a separate signal representing the original frequency signal, a laser control unit to receive the two-tone frequency modulated signal from the two-tone generator, the laser control unit having a ramp generator to control the laser driver current so that the frequency of the laser scans repeatedly and rapidly across the absorption range of interest, the laser control unit superimposing the two-tone frequency modulated signal onto the laser driver current to generate with the diode laser the laser beam for transmission, demodulating means to receive the detected laser beam and output a demodulated signal, and a mixer means for receiving from the demodulating means the demodulated signal, and receiving from the two-tone generator the signal representing the original frequency signal, the mixer producing a DC output signal proportional to the detected differences between the demodulated signal and the signal representing the original frequency signal, and processing means for providing the concentration of the selected trace constituent based upon the DC output signal, as now claimed in independent claims 21, 38, and 45.

Since Partridge et al. employs a broadband light source that uses an interference filter to modulate the wavelength of the radiation beam to obtain a specific wavelength band there is no suggestion to modify it to incorporate a tunable diode laser with control means to control the laser as now claimed to modulate the signal. Moreover, since Whittaker et al. is a laboratory set-up there is no suggestion, in applicant's submission, that it can be applied to remote measurements of trace gasses.

Even if the teachings of Whittaker et al., were applied to Partridge et al., as suggested by the Examiner, there is no suggestion that the claimed invention would be achieved—Whittaker et al.'s triangular modulations applied to the laser to reduce etalons is distinctly different from the two-tone frequency modulated signal as now claimed. In short, there is no technological motivation for engaging in the modification or change as suggested by the Examiner.

Accordingly, applicant submits that neither Partridge et al., nor Whittaker et al., either singly or combined disclose or suggest the inventions recited in claims 21, 38, and 45. Dependent claims 24–37, 39–44, 46–48, and 51–52, incorporate all of the limitations thereof, and applicant submits that these claims should be allowable as well.

Boisde et al., is relied upon by the Examiner to show that it is known to use optical fibers to carry light to and from measuring stations and that a single light source and detector can be used to monitor multiple test areas by multiplexing the light. However, Boisde et al., does not concern itself with an apparatus (and corresponding method) for monitoring selected trace constituents in exhaust gases, the apparatus comprising a diode laser tuneable over a range of frequencies for generating a laser beam, the diode laser located remotely from the exhaust gases, and a control means to control the laser to modulate the signal as now claimed in independent claims 21, 38, and 45. As claims 24–37, 39–44, 46–48, and 51–52, include all the limitations of the respective independent claims 21, 38, and 45, applicant submits that neither Partridge et al., Whittaker et al., nor Boisde et al., taken either alone or in combination, as suggested by the Examiner, disclose or suggest all of the claimed limitations; the combination of Partridge et al., Whittaker et al., and Boisde et al. does not produce the claimed invention and does not render these claims obvious.

IV. Conclusion.

Applicant respectfully submits that this application is in condition for allowance, and an early indication thereof is respectfully solicited. Should the Examiner

have any questions or concerns regarding the amendments presented herein, the Examiner is invited to contact the undersigned representative of the Applicant.

Respectfully submitted,

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